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PELLAGRA.

LABORATORY EXAMINATIONS IN CONNECTION WITH THE DISEASE.

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The treatment of pellagra patients by the United States Public-Health Service at Savannah, Ga., has afforded opportunity for certain laboratory examinations of feces, blood, and urine.

FECES.

Several observers have reported on the prevalence of intestinal parasites in pellagra.

Siler and Nichols,¹ summarizing their observations at the Peoria State Hospital during 1909, report that "Stool examinations in 92 cases disclosed the fact that 84.8 per cent of the pellagrins were infected with intestinal protozoa (endamoebæ and flagellates); 36.8 per cent of these protozoal infections were endamoebæ, and while no classification of these endamoebæ was attempted, they were clearly pathogenic in the large majority of these cases, as was evidenced by the symptomatology and by the appearance of the intestines at necropsy." They found further that "of 107 nonpellagra patients, 50.5 per cent were infected with intestinal protozoa, of which 14 per cent were endamoebæ."

From their observations at Peoria during 1910 they report that of 50 nonpellagrous patients, 52 per cent showed endamoebæ and 60 per cent showed flagellates, and of 21 pellagrous patients 76 per cent showed endamoebæ and 76 per cent showed flagellates.

In this series they found both pathogenic and nonpathogenic endamoebæ and considered the flagellates as "mainly *Trichomonas intestinalis*."

During the same year they studied protozoal infection among the patients ("practically all nonpellagrous") at Kankakee and Dunning. At the former place, of 62 patients 58 per cent showed endamoebæ and 77 per cent showed flagellates. At the latter place, of 50 patients, 46 per cent showed endamoebæ and 32 per cent showed flagellates. No attempt was made at either place to classify the endamoebæ. The flagellates were mainly *Trichomonas intestinalis*.

Willetts² examined the feces of 500 unselected insane negro females at the Georgia State Sanitarium, 35 of whom were pellagrins, with the following results.

¹ J. F. Siler and H. J. Nichols in Report of the Pellagra Commission of the State of Illinois, November, 1911, Ch. IV, p. 44.

² From Pellagra, by S. R. Roberts, 1912, p. 77.

	Number examined.	Number of pellagrins.
	500	35
	<i>Per cent.</i>	<i>Per cent.</i>
Infections.....	50	40
Ascaris.....	28.2	8.57
Trichuris.....	40.2	17.14
Strongyloides.....	18.2	25.71
Uncinaria.....	11.8	20.71
Hymenolepis.....	0.2	2.86

Allen ¹ has reported the presence of amœbiasis complicating pellagra and has called attention to the necessity for careful differential diagnosis.

The series here reported is based upon microscopical examinations for intestinal parasites of the feces from 95 pellagrins.

Technic.

The following technic was used:

A small portion of feces was emulsified in a large drop of warm salt solution on a slide and covered with a 22 by 40 mm. cover glass, making a preparation of a suitable thickness to be examined with an oil-immersion objective. All preparations were examined with the low power and 1/12 oil-immersion lenses with daylight illumination, and about three-fourths of the preparations were examined in addition with the use of a dark-field illuminator. This apparatus has been found of great value in studying motile organisms and in counting the flagella of certain intestinal parasites.

Results of Fecal Examinations.

A total of 1,040 microscopical examinations has been made of the feces of 95 pellagrins.

Only 1 specimen was obtained for examination from 14 of the patients. The largest number of examinations of different specimens from one patient was 83.

Of the 14 patients from whom only 1 specimen was examined only 4 were positive for intestinal parasites. It is believed that examinations of additional specimens would have shown a higher percentage of infection, as it was repeatedly found that specimens from patients known to be infected with intestinal parasites were negative in many examinations.

Stools were brought to the laboratory each morning, all having been passed after 6 p. m. on the previous evening, and the great majority after 4 a. m. on the day of examination.

¹ Amœbæ in the Stools of Pellagrins, Allen. Transactions of National Conference on Pellagra at Columbia, S. C., 1909, p. 219.

The great majority were examined within six hours after passage.

Stools were noted of every degree of consistency from liquid to solid and varying much in color. The most characteristic stool noted during the acute stages of the diseases was a copious mushy and frothy stool of a pale yellowish color or with a slight grayish shade, the frothiness being due to the presence of bubbles from fermentation.

Results of fecal examinations of pellagra patients for intestinal parasites were as follows:

Table No. 1.

Examinations and infections.	Number.	Per cent.
Total number patients examined.....	95
Total number patients infected.....	56	58.9
Patients infected with:		
Trichomonas.....	41	43.1
Endameeba coli.....	22	23.1
Lambliia intestinalis.....	18	18.9
Necator americanus.....	10	10.5
Strongyloides stercoralis.....	2	2.1

Degree of infection.—Classed according to the degree of infection with intestinal parasites we find:

Table No. 2.

Examinations and infections.	Number.	Per cent.
Total number of patients examined.....	95
Total number of patients infected.....	56	58.9
Patients infected with:		
One species.....	28	29.4
Two species.....	20	21.0
Three species.....	7	7.3
Four species.....	1	1.05

Race and sex.—Infections were distributed according to race and sex, as follows:

Table No. 3.

Examinations and infections.	Total number.	White.				Colored.			
		Male.		Female.		Male.		Female.	
		Num-ber.	Per-cent.	Num-ber.	Per-cent.	Num-ber.	Per-cent.	Num-ber.	Per-cent.
Patients examined.....	95	53		39		2		1	
Patients infected.....	56	42	79.2	12	30.7	1	50	1	100
Patients infected with:									
One species.....	28	19	35.8	8	20.5	0	0	1	100
Two species.....	20	15	28.3	4	10.2	1	50	0	0
Three species.....	7	7	13.2	0	0	0	0	0	0
Four species.....	1	1	1.8	0	0	0	0	0	0
Trichomonas.....	41	30	56.6	9	23.0	1	50	1	100
Endameeba coli.....	22	20	37.7	1	2.5	1	50	0	0
Lambliia intestinalis.....	18	14	26.4	4	10.2	0	0	0	0
Necator americanus.....	10	9	16.9	1	2.5	0	0	0	0
Strongyloides stercoralis.....	2	1	1.8	1	2.5	0	0	0	0

Trichomonas.—Flagellates of the genus *Trichomonas* were observed more often than any other intestinal parasites, being found in 43.1 per cent of cases.

From the same patient, forms were observed with three or with four anterior flagella, either form being with or without an undulating membrane and with or without an additional trailing flagellum. When present, this trailing flagellum was apparently a continuation of the outer edge of the undulating membrane.

It is undecided whether both of these should be included under the species *Trichomonas hominis* or whether two species are represented.

These organisms were pear shaped and from 12 to 25 microns in length. In stained specimens a nucleus was observed near the anterior end. Flagella were counted with the aid of the dark-field illumination after active motility had ceased.

Although often found in diarrheic stools there is no evidence that they caused any symptoms. Pellagrins not harboring these parasites suffered from periods of diarrhea fully as often as those who were infected.

Endamæba coli.—These endamæbæ were found in 23.1 per cent of patients. Diagnosis depended upon the finding of motile and encysted forms with eight nuclei in all but two cases. In these two cases diagnosis was made from motile forms, with sluggish motility, distinct nuclei, and an absence of ingested erythrocytes. No pathogenic endamæbæ were found.

Lambliæ intestinalis was observed in 18.9 per cent of cases, both motile and encysted forms being seen.

Necator americanus.—This hookworm infection was observed in 10.5 per cent of cases.

Strongyloides stercoralis.—This infection was observed in two patients, diagnosis being made from the presence of rhabditiform embryos in fresh stools. No symptoms were noted from the infection.

Other observations.—Observations were made in addition to the above-mentioned parasites as follows:

Yeasts were observed in the majority of stools of a liquid or semi-solid consistency, being most prevalent in those which were frothy. They are considered as belonging to the genus *Monilia* from the presence of mycelial elements. It has been possible to isolate some of these yeasts for the purpose of cultural study, and further observations are in progress.

Fine motile spirochætes or treponema-like organisms with from 4 to 12 turns were noted in 18, or 18.9 per cent of patients. Their motility was of a corkscrew character.

Motile spirilla with from 2 to 5 turns were noted in the stools of 26, or 27.3 per cent of patients. They were very active, with short forward and backward excursions and motility of a corkscrew character.

They were easily stained with dilute carbol fuchsin and measured in length from 4 to 12 microns. Attempts at cultivation were negative.

None of the above-mentioned intestinal parasites or other organisms were in any way considered as the etiological agents in pellagra.

BLOOD.

Complement Fixation tests.

Literature.—Bass¹ reports complement fixation tests on 16 pellagrins, using lecithin as antigen. Two of these patients had syphilis, 1 had malaria, and one test was made upon old necropsy blood. Of the remaining 12, 8 gave a positive reaction. He draws no conclusion from this small series.

Fox² examined 30 cases of pellagra, using the Noguchi modification of the Wassermann reaction. Excluding 1 patient, who probably had syphilis, he obtained in 2 cases a positive reaction of moderate intensity and in 5 cases a weakly positive reaction, the rest being negative. He concludes that "cases of pellagra do not often give a positive Wassermann reaction."

Lorenz,³ working with Dr. S. S. Hindman at the Georgia State Sanitarium, reports on the Wassermann examinations of spinal fluid and blood serum of 106 pellagra patients. Of this series 8 cases gave a positive Wassermann with both spinal fluid and blood serum, and gave other evidence of having syphilis complicated with pellagra. In addition, 2 other cases gave weakly positive reactions with blood serum alone, the specimens being taken a few days before death.

The technic consisted in the use of the human or Noguchi hæmolytic system with two antigens, one an alcoholic extract of luetic liver and the other cholesterin-fortified antigen, made from guinea-pig heart according to the Noguchi method.

The conclusion drawn by Lorenz was that the Wassermann is negative with a few exceptions. In his investigation the exceptions were moribund cases which gave weakly positive reactions with blood serum.

Technic.—In the series here reported complement fixation tests were made upon specimens of blood from 55 pellagra patients.

The technic of Noguchi was followed with the modification that the blood corpuscles were sensitized with amboceptor before the second incubation of the actual test.

The following reagents were used:

Antigen—the acetone insoluble fraction of human syphilitic heart.

¹ Complement Fixation with Lecithin as Antigen in Pellagra—Further Observations. C. C. Bass. Transactions of National Conference on Pellagra at Columbia, S. C., 1909, p. 150.

² The Wassermann Reaction (Noguchi Modification) in Pellagra—Report of Thirty Cases. Howard Fox. Transactions of National Conference on Pellagra, 1909, p. 152.

³ The Cerebrospinal Fluid in Pellagra. W. F. Lorenz. Public Health Reports, vol. 29, No. 37, Sept. 11, 1914.

Complement—the fresh blood serum of guinea pigs.

Amboceptor—the serum of rabbits immunized against human erythrocytes.

Blood-corpusele suspension—a 1 per cent suspension of human erythrocytes in normal salt solution.

Patients' serum—active and inactive.

The amounts of antigen, complement, and patients' serum were used as recommended by Noguchi and incubated in the water bath at 37° C. for 30 minutes.

Amboceptor and corpuscles were treated as follows:

The necessary amount of amboceptor paper, allowing two units for each tube, to be used, was immersed in normal salt solution and extracted for 30 minutes, in the proportion of 20 units of amboceptor paper to 2 c. c. of salt solution.

A 10 per cent suspension of washed human corpuscles was made in normal salt solution.

Then 2 c. c. of the amboceptor solution and 1 c. c. of the 10 per cent corpuscle suspension were put in a centrifuge tube and the volume was made up to 10 c. c. with normal salt solution, thus allowing two units of amboceptor to each c. c. of 1 per cent washed corpuscles. This hæmolytic system was incubated in the water bath at 37° C. for 30 minutes alongside the tubes being incubated for complement binding.

The hæmolytic system was then centrifuged and the supernatant fluid pipetted off, leaving the sensitized cells, to which was added salt solution to make a 1 per cent suspension.

One c. c. of this suspension was then added to each tube for the second incubation of the actual test, and the results were read at the end of one hour.

Control tubes without antigen and control tests with known positive and negative sera were always used.

The same technic has been used satisfactorily in making about 600 routine complement fixation tests for syphilis at this hospital.

The patients were tested soon after admission to the hospital and all were typical cases of pellagra with manifestations varying from those of an acute attack to those of a chronic character.

Results.—The complement fixation tests were all negative and no evidence was found that uncomplicated pellagra ever gives a positive Noguchi reaction.

Blood Counts, Hæmoglobin Estimations, and Differential Leucocyte Counts.

Literature.—Lavinder,¹ after reviewing the literature on this subject, remarks that the results reported “seem decidedly discordant, but one may at least conclude that there is a very frequent, usually

¹ Notes on the Hematology of Pellagra. C. H. Lavinder. Transactions of National Conference on Pellagra, Columbia, S. C., 1909, p. 33.

mild, anemia of the secondary type, and if there are qualitative changes in the red cells, they are only such as one would expect. The differential leucocyte counts seem almost too discordant to reconcile in any way, but there would seem a majority opinion of a definite, relative large mononuclear increase."

As a result of his own work on 24 cases he found a secondary anemia, a general absence of leucocytosis in uncomplicated cases, and a relative large mononuclear increase.

Daspit¹ reports on 20 cases, finding a slight decrease in leucocytes and a relative lymphocytosis more marked in the small mononuclears.

Hyde² reports on blood examinations of 9 pellagrins at Peoria, finding a slight grade of anemia, and an increase of large mononuclears in 5 cases.

Ormsby and Singer,³ from the examination of 9 pellagrins, report a relative lymphocytosis and a diminution in the proportion of large mononuclear leucocytes.

Roberts,⁴ in his book on pellagra, states "The principal change in the corpuscles is an increase in the percentage of the small lymphocytes, and this is usually accompanied by a decrease in the normal per cent of polynuclear cells. This increase in the small lymphocytes is the one characteristic of the blood in pellagra."

Hillman,⁵ in a series of 32 counts, reports an average leucocyte count of 10,403 per cubic millimeter, an average lymphocyte count of 33.99 per cent and an average large mononuclear count of 2.59 per cent. The following is quoted from his summary: "The lymphocytosis is interesting and is probably in accordance with the general cachectic condition of most pellagrins, who are also often the subjects of gastro-intestinal disorders."

It is evident from the observations upon the blood recorded by various workers that in general there is an agreement as to a mild degree of secondary anemia and an occasional unexplained leucocytosis. Reports in regard to differential counts, however, show a marked variance in regard to the number of lymphocytes and large mononuclear leucocytes which is probably mainly due to the personal equation of the counters.

Technic.—In this series observations were made upon the blood of 28 pellagra patients to determine the number of red and white

¹ Some Blood Findings in Twenty Cases of Pellagra in the Insane Asylum of the State of Louisiana. H. Daspit. Reprint from New Orleans Medical and Surgical Journal, vol. 62, March, 1910.

² Pellagra, and Some of Its Problems. J. N. Hyde. Extract from the American Journal of the Medical Sciences, January, 1910.

³ Clinical and Pathological Studies. O. S. Ormsby and H. D. Singer. Report of the Pellagra Commission, State of Illinois, 1911, p. 22.

⁴ Pellagra, by S. R. Roberts, 1912, p. 185.

⁵ Some Hematological Findings in Pellagra. O. S. Hillman. Reprint from the American Journal of the Medical Sciences, April, 1913, No. 4, Vol. CXLV, p. 507.

cells per cubic millimeter, the differential leucocyte count, the hæmoglobin content, the color index and the appearance of cells in stained specimens.

The red cells were counted with a Thoma-Zeiss apparatus with a dilution of 1 to 200 and counting 180 small squares in each of two drops.

The white cells were counted with a Thoma-Zeiss apparatus using a dilution of 1 to 20 and counting 9 square millimeters.

The hæmoglobin estimations were made with a Tallqvist hæmoglobin scale.

The differential leucocyte counts were made from slides stained with Leischmann's stain, from 200 to 500 leucocytes being counted in the central portion of the smear.

Results.—The following results were obtained from blood counts of 28 pellagra patients:

The largest number of red cells per cubic millimeter was 5,840,000 and the smallest number 2,960,000. The average number was 4,720,000.

The largest number of leucocytes per cubic millimeter was 14,200 and the smallest number 4,200. The average number was 8,027.

Differential counts: Polymorphonuclear neutrophiles varied from 54 to 82 per cent, with an average of 68.2 per cent.

Lymphocytes varied from 9 to 34 per cent, with an average of, 20.9 per cent.

Large mononuclear leucocytes varied from 3 to 14 per cent, with an average of 8.5 per cent.

Eosinophiles varied from 0 to 12 per cent, with an average of 2.2 per cent.

The average percentage of basophiles was 0.07.

The average percentage of hæmoglobin was 77.

The average color index was 0.81.

There was no noteworthy departure from the normal in the size, shape, or staining of the red corpuscles.

Conclusions.—These figures do not show any marked variation from normal beyond a mild degree of secondary anemia. No constant or characteristic change was noted which would be of material help in the diagnosis of this disease.

Acknowledgment is due to Drs. B. H. Sanchez, Q. Taylor, and William B. McWhorter for assistance in blood examinations.

URINE.

Observations were made upon the urine in regard to reaction specific gravity, and the presence of albumin, sugar, and indican.

Reaction.

Marie¹ reports that in 100 cases the urine was 76 times slightly acid, 14 times neutral, and 10 times alkaline, and states that Calderini, in an examination of 33 cases, found 21 per cent of the urines strongly acid, 57 per cent of slight acidity, 12 per cent neutral, and 9 per cent alkaline.

In this series the urines of 100 pellagra patients were tested with litmus and found acid in 96 instances and alkaline in 4 instances.

Specific Gravity, Albumin, and Sugar.

The average specific gravity of these urines was 1,018.3.

Albumin not to exceed a slight amount was found in 9 instances.

All examinations for sugar were negative.

Indican.

The presence of indican in the urine of pellagrins has been noted as of common occurrence.

Thus Lavinder and Babcock² state: "We have found indican almost constantly in the urine, and albuminuria has not been rare in our experience. J. J. Watson examining the urine of 12 patients 180 times, found indican present 175 times."

Ormsby and Singer,³ referring to urine examination, state: "No constant changes have been found with the exception of a very marked indican reaction which was present in all and can probably be correlated with the intestinal putrefaction."

Myers and Fine,⁴ in a series of urine examinations, find "The absolute amounts of the ethereal sulphates appear to be increased in a few instances; this is especially pronounced in the cases of anacidity, in which very large amounts of indican were eliminated."

In the series here reported the urines of 57 patients were tested for indican a total of 2,524 times on different days. Results were positive for indican in 55, or 96.4 per cent of patients.

Technic.—A few cubic centimeters of Obermayer's reagent were mixed with an equal quantity of urine and allowed to stand for five minutes. Then chloroform was added in the proportion of 2½ c. c. to 10 c. c. of the above mixture, and the resulting mixture poured slowly backward and forward from one tube to another.

Indican, when present, becomes absorbed by the chloroform, which becomes of a more or less deep shade of blue.

According to the color resulting, which varied from a light to a very deep blue, the positive results were graded as 4 +, 3 +, 2 +, and 1 +.

¹ Pellagra. A. Marie. Translated by C. H. Lavinder and J. W. Babcock, 1910, p. 215.

² *Ibid.*, p. 218.

³ In Report of the Pellagra Commission of the State of Illinois, Nov., 1911, p. 23.

⁴ Metabolism in Pellagra. V. C. Myers and M. S. Fine. Reprinted from the American Journal of the Medical Sciences, May, 1913, p. 705.

A 4 + reaction equals a full strength reaction, a 3 + reaction equals three-fourths of a full reaction, a 2 + reaction equals one-half of a full reaction, and a 1 + reaction equals one-fourth of a full reaction.

The total number of 2,069 positive tests was graded as follows:

Number 4 + reactions.....	1,437
Number 3 + reactions.....	194
Number 2 + reactions.....	231
Number 1 + reactions.....	207

Results.—The following table gives in detail the results of indican tests:

Table No. 4.

Patient—	Number of days in hospital.	Number of tests.	Number positive.	Number negative.	Number 4+.	Number 3+.	Number 2+.	Number 1+.
No. 62.....	46	8	8	0	8	0	0	0
No. 68.....	82	36	36	0	36	0	0	0
No. 124.....	31	22	17	5	11	0	3	3
No. 137.....	121	48	47	1	47	0	0	0
No. 150.....	73	54	51	3	42	5	3	1
No. 151.....	40	33	26	7	23	1	0	2
No. 167.....	56	47	42	5	35	2	1	4
No. 168.....	40	33	15	18	3	0	8	4
No. 169.....	23	17	14	3	6	1	5	2
No. 170.....	6	2	2	0	2	0	0	0
No. 171.....	49	42	41	1	39	0	0	0
No. 173.....	46	37	37	0	34	2	0	1
No. 175.....	158	73	73	0	66	6	0	1
No. 177.....	26	20	11	9	4	0	2	5
No. 178.....	38	32	23	9	2	4	8	9
No. 179.....	138	110	110	0	109	1	0	0
No. 181.....	15	11	11	0	11	0	0	0
No. 182.....	55	46	46	0	44	2	0	0
No. 183.....	127	91	91	0	83	6	2	0
No. 186.....	147	117	47	70	33	1	3	10
No. 187.....	27	27	27	0	17	5	5	0
No. 188.....	208	156	147	9	131	10	4	2
No. 189.....	115	83	33	50	26	4	2	1
No. 190.....	39	28	24	4	0	1	9	14
No. 191.....	71	54	51	3	39	6	5	1
No. 192.....	66	55	54	1	10	8	22	14
No. 194.....	186	153	123	30	82	18	11	12
No. 195.....	4	3	3	0	3	0	0	0
No. 196.....	80	65	62	3	45	9	5	3
No. 198.....	13	12	12	0	7	2	2	1
No. 199.....	61	51	48	3	33	5	7	3
No. 201.....	102	81	78	3	67	9	2	0
No. 202.....	91	78	70	8	55	6	6	3
No. 203.....	31	17	7	10	0	0	5	2
No. 204.....	106	84	60	24	15	7	21	17
No. 205.....	90	80	45	35	33	7	4	1
No. 206.....	21	19	15	4	8	3	3	1
No. 207.....	30	24	11	13	0	0	3	8
No. 208.....	192	154	135	19	49	10	40	36
No. 209.....	26	21	12	9	4	3	1	4
No. 210.....	18	12	8	4	3	1	1	3
No. 211.....	20	23	12	11	11	0	0	1
No. 212.....	12	8	6	2	2	2	1	0
No. 213.....	39	34	34	0	33	1	0	0
No. 214.....	77	54	53	1	36	9	6	2
No. 215.....	45	35	11	24	2	1	1	7
No. 216.....	42	33	14	5	2	2	0	1
No. 218.....	20	33	30	3	14	12	1	3
No. 219.....	30	22	0	22	0	0	0	0
No. 220.....	16	11	0	11	0	0	0	0
No. 221.....	30	21	14	7	4	2	3	5
No. 222.....	57	37	36	1	19	8	8	1
No. 223.....	56	29	27	2	8	3	8	8
No. 224.....	44	22	22	0	13	7	1	1
No. 225.....	66	25	25	0	25	0	0	0
No. 226.....	29	16	14	2	0	0	6	8
No. 227.....	14	4	4	0	0	0	3	1
Total.....	3,501	2,524	2,069	455	1,437	194	231	207

A study of this table shows that more than four-fifths of the tests were positive.

In connection with the frequent occurrence of indicanuria in pellagra it is of interest to note that this condition is reported as of frequent occurrence in sprue, a disease having in many respects a striking clinical resemblance to pellagra.

Achlorhydria has been reported as an accompaniment of indicanuria and in many pellagra patients there is reported to be found a total or partial absence of free hydrochloric acid in the stomach contents. We have no data in the present series to form an opinion in regard to the possible relation of these two conditions.

Only two patients showed a total absence of indican, one being tested 22 times and the other 11 times.

Patient No. 219, tested 22 times, was classed as a moderately severe case with predominating nervous symptoms. Skin symptoms had practically disappeared upon entrance to the hospital. He had a red and fissured tongue and burning in the stomach with flatulence. He had no diarrhea. The most troubling symptoms were dizziness, pains in the legs, and burning in the feet.

Patient No. 220, tested 11 times, was a boy of 16 with scaling dermatitis involving the hands, feet, and legs. He had no gastrointestinal symptoms and only slight nervous symptoms.

All patients improved under treatment with the exception of one (No. 195), who died, and two (Nos. 62 and 124), who were discharged not improved.

No. 62 showed eight 4+ tests of a total of eight. No. 124 showed eleven 4+, three 2+, and three 1+ of a total of twenty-two tests.

In order to judge of the effect of convalescence from the disease upon the presence or absence of indicanuria all the patients were selected who showed improvement or apparent recovery under treatment and upon whom at least 20 tests were performed.

Table No. 5 gives the numbers of these patients, with the results of the first 10 tests performed in comparison with the last 10 tests.

Table No. 5.

Patient—	First 10 tests.					Last 10 tests.				
	Number 4+.	Number 3+.	Number 2+.	Number 1+.	Number nega- tive.	Number 4+.	Number 3+.	Number 2+.	Number 1+.	Number nega- tive.
No. 68.....	10	0	0	0	0	10	0	0	0	0
No. 137.....	10	0	0	0	0	9	0	0	0	1
No. 150.....	10	0	0	0	0	1	0	0	0	9
No. 151.....	10	0	0	0	0	7	0	0	2	1
No. 167.....	8	0	0	0	2	10	0	0	0	0
No. 168.....	1	0	0	0	9	0	0	2	0	8
No. 171.....	7	2	0	0	1	10	0	0	0	0
No. 173.....	10	0	0	0	0	10	0	0	0	0
No. 175.....	10	0	0	0	0	4	6	0	0	0
No. 177.....	3	0	0	2	5	1	0	2	3	4
No. 178.....	2	3	0	5	0	0	0	4	1	5
No. 179.....	10	0	0	0	0	10	0	0	0	0
No. 182.....	10	0	0	0	0	10	0	0	0	0
No. 183.....	9	1	0	0	0	5	4	1	0	0
No. 186.....	9	0	1	0	0	0	0	0	0	10
No. 187.....	9	1	0	0	0	1	4	5	0	0
No. 188.....	10	0	0	0	0	10	0	0	0	0
No. 189.....	6	0	0	0	4	0	0	0	0	10
No. 190.....	0	1	5	2	2	0	0	1	9	0
No. 191.....	9	1	0	0	0	10	0	0	0	0
No. 192.....	6	2	2	0	0	0	0	2	0	8
No. 194.....	4	0	0	0	6	0	0	0	4	6
No. 196.....	0	1	3	3	3	9	0	1	0	0
No. 199.....	6	1	1	2	0	4	1	2	1	2
No. 201.....	6	0	1	0	3	10	0	0	0	0
No. 202.....	3	1	1	1	4	9	1	0	0	0
No. 204.....	4	2	4	0	0	0	0	1	5	4
No. 205.....	4	2	3	0	1	10	0	0	0	0
No. 207.....	0	0	2	0	8	0	0	1	7	2
No. 208.....	4	0	2	4	0	5	2	2	1	0
No. 209.....	4	2	0	0	4	0	1	1	3	5
No. 211.....	4	0	0	0	6	7	0	0	1	2
No. 213.....	10	0	0	0	0	10	0	0	0	0
No. 214.....	7	0	3	0	0	9	0	0	0	1
No. 215.....	0	0	0	2	8	2	0	0	1	7
No. 218.....	8	2	0	0	0	1	3	0	3	3
No. 221.....	0	0	2	4	4	4	2	1	1	2
No. 222.....	4	4	0	1	1	3	3	0	4	0
No. 223.....	6	1	0	3	0	0	0	5	5	0
No. 224.....	7	1	1	1	0	4	6	0	0	0
No. 225.....	10	0	0	0	0	10	0	0	0	0
Total.....	250	28	31	30	71	205	33	31	51	90

This table shows that of the 410 first tests 339 were positive, while of the last 410 tests only 320 were positive, and of the first 339 positive only 8.8 per cent were 1+, while of the last 320 positive 15.9 per cent were 1+.

This would indicate that as convalescence is established the presence of indicanuria becomes lessened.

The presence of indicanuria in 96.4 per cent of these patients would suggest this symptom as a possible aid in diagnosis in doubtful cases provided repeated tests were made.

PLAGUE-PREVENTION WORK.

CALIFORNIA.

The following reports of plague-prevention work in California were received from Surg. Boggess, of the United States Public Health Service, in charge of the work: